

## OBSERVING EMOTIONAL EXPERIENCES IN ONLINE EDUCATION

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### ABSTRACT

*This paper examines the significance of emotion for the processes of teaching, studying and learning. The goal is to demonstrate on the basis of both theoretical examination and empirical data. Emotional processes are crucial for human learning and should be taken into account in online teaching and learning as well. Emotional factors during studying influence in several ways as, whether one studies, how one studies, whether one learns and whether one remembers what one studied, etc. The study also examines online group dynamics in online teaching and studying from the point of view of shared emotional states and online conveyance of emotions. Emotional situations related to studying are also examined from the cognitive and emotional point of view and via the concepts of situational anxiety and situational pleasure. The examples in the empirical data were collected during 2005-2006 from online courses of the Cornet project. The data was analyzed by classifying the data referring to emotionality with nVivo program under special themes as described in this paper. The data contain student essays "I as a learner during the Education, organisations and culture" study unit (N=12) and students' study-related email messages during the "Learning organisation and small group dynamics" study unit (N=28).*

*Keywords: emotions, feelings, online education.*

### INTRODUCTION

A feeling is a state of mind with a connection to both psychical and somatic experiences and strongly anchored in physical experience and bodily feeling (Damasio, 2001/1994; Ihalainen, 2004). By emotion we refer to mental activity that is comparable to perception, thinking, language and learning, which also produces feelings (Damasio, 2001, 2001/1994; cf. Nathanson 1992; Tomkins 1962, 1963, 1991, 1992). Emotions are consciously or unconsciously generated processes with negative or positive tones that help to estimate the significance of situations and actions and their value for one's self (cf. *Information theory of emotions*, Simonov, 1981; cf. Nathanson 1992; Tomkins 1962, 1963, 1991, 1992). According to the contemporary view, emotional processes are located not only in the evolutionarily old parts of the brain, the so-called limbic system, but emotions are found throughout the entire brain (Kernberg, 1995; Siegel, 1999).

One may claim that processes on the emotional level serve to give direction and impetus for such human activities that appear rational. Studying via online networks is no exception to this. (Damasio, 2001/1994;

Ihalainen, 2004; Siegel, 1999). To quote Damasio (2000/1999b, 257/258), the concept of consciousness can be reversed, consciousness is a strongly emotional experience, *a feeling of what is happening*. Emotions are experienced as episodes and mental states of various types, such as happiness, sadness, hatred or anxiety. A large number of emotional processes are barely conscious or unconscious. (Damasio, 2000/1999b; Oatley & Jenkins, 1996; Siegel, 1999). Emotions might be considered as processes, with identifiable stages: initially events are evaluated for their relevance to what is important to us, then followed by an evaluation of the context, and what can be done about the event (Oatley & Jenkins, 1996). Emotions may be seen as mental stages of readiness for action, setting priorities and prompting plans.

One can see the human emotional activity in teaching, studying and learning (Illeris 2002; Ullens, 1997) with the aid of theoretical level structure construct based on multiple levels of observation. The emotionality is seen in it on five levels of observation: 1) The level of subject's internal emotional neural mechanisms (neuropsychology / cognition science), 2) The level of subjects' emotional

aspects of behaviour as a subject 3) The social level of shared feelings and emotionality as subject as a member of groups, (emotionality in social interaction between teachers, students and learners as subjects) in joint attentions. 4) The emotionality in cultural level, 5) The emotionality in inter- or transcultural level in global-level social interaction between teachers, students and learners with different cultural backgrounds. These highest levels are not more discussed in this paper. (see Tella, Lehtonen et al. 2004; Lehtonen, Vahtivuori-Hänninen et al. 2003; Lehtonen & Vahtivuori 2003; Uhari & Nieminen 2001).

The importance of emotions and social cognition for interaction and collaboration is obvious (Bion, 1962; Damasio, 2000/1999a, 2000/1999b; Pitkänen, 2003; Siegel, 1999). A person's emotions and the so-called manifestations of embodiment may be seen as significant factors for the processes of teaching, studying and learning as well. Emotions and the tendency to assess experiences on the basis of how pleasurable or disagreeable they are, (for more detail, see Siegel, 1999; Simonov, 1981; Sinkkonen & Kalland, 2001) are not only background factors for inclination to study and motivation but also directly bear on how one studies, what one studies, whether one learns anything and whether, what one learns is remembered (Damasio, 2000/1999a, 2000/1999b; Pitkänen, 2003; Siegel, 1999; Virsu, 1995). The body, the brain, the intellect and emotions are inseparable parts of us. The physiological-psychological activities labelled as the mind are generated in a functional whole of the body and its environment, not only in the brain or data processing. (Alanen, Sintonen, Hyyppä, & Jörvillehto, 2003; Damasio, 2000/1999a, 2000/1999b; Dennett, 1996).

Social interaction on the level of feelings, online group dynamics and the manifestations and interpretations of embodiment must all be paid considerable attention to when planning for online teaching. The present interactive facilities, being mostly text-based, place great demands on interaction. Both the technology used and teaching and studying arrangements influence what emotions are evoked and conveyed by studying and

what students experience. Online studying, on the other hand, entails protection afforded by technological conveyance, an option to withhold one's true feelings. This experiential emotional protection may also make collaboration on the level of feelings easier in a group and lead to extended openness, even to an extent rarely encountered in personal interaction.

How are social activity, social ties and communities created when the participants do not meet each other? Personal interaction is not always necessary for establishing social ties but what is necessary is reading or understanding, by various means, the minds of others online, *a meeting of the minds*.

Imagination, the ability to empathise, entering into another person's role and emotional reciprocity are essential factors in mind reading for generating a shared mutual emotional state. (Chayko, 2002; Damasio, 2000/1999b). How is an emotional and social connection made and maintained in an online study? For creating and maintaining socio-mental connections, human memory and experienced emotions are crucial. When interacting, participants evoke emotional states through various symbols, pictures, rituals, spoken sentences, written texts as well as through mental imagery and thinking. These emotions serve to create a shared emotional state, "carry" the other participants and simulate the states of mind of others. For generating socio-mental connections, people utilise a human mode of action called embodiment. As implied in a dialogue, 'one not only interacts with information but also on the individual level as a member of a group', the connections are strongly both emotional and cognitive. (Chayko, 2002; Damasio, 2000/1999b; Hari, 2003; Ihminen, 2004; Siegel, 1999).

Both attachment relations research (e.g. Simpson & Rholes, 1998; Sinkkonen, 2004; Sinkkonen & Kalland, 2001) and neuroscientific research on emotions (e.g. Adolphs, 2002; Borod, 2000; Pitkänen, 2003; Siegel, 1999) and mirror neurons (e.g. Pitkänen, 2003; Wolf, Gales, Shone, & Shane, 2000) provide a possible explanation for the meeting of the minds. Presumably, the participants are able to empathise through interactive and

attachment relations experiences in childhood and through the emotion and mirror neuron systems, as described by neurosciences, i.e., can examine situations from the viewpoint of others and also interpret and express bodily expression through text-based interaction. Important elements of this communication, in addition to written text, are the other qualities of text-based communication, for example, the rhythm, intensity and tone of communication and the length of replies. In each case of different multimedia communication, different options come into play, with voice over IP giving such communication extra dimensions and IP videoconferencing its own, particularly in the domain of nonverbal communication (see more e.g. Lehtonen, Karpainen, Matikainen, Säkkinen, & Ruokamo, 2005). In addition, communicative proficiency and learned skills in using these tools for conveying one's communication have a major effect. (Gallese & Goldman, 1998; Haapasalo, 2001; Hari, 2003).

In addition to the concepts of interaction and emotion, it is necessary to examine the concept of learning process. Learning can be defined as a long-term change of knowledge, skills and practice that is based on alterations in the neurological system (c.p. Virsu, 1991, 1995). In this connection one can separate the concepts of *teaching*, *studying* ( $\approx$  *learning activity*) and *learning* (Illeris, 2002; Uljens, 1997). Teaching and studying are activities whereas learning itself, as a neuropsychological and neurobiological event, is connected to this process as an expected outcome of activity that is separate in time (Lehtonen & Vahtivuori, 2003) because permanent learning requires that the brain has time to reorganise after studying (Haapasalo, 1993; (Virsu, 1991, 1995); Hari, 2003; Virsu & Haapasalo, 2001).

It is not possible to offer a functional online study unit that is appropriate socially, cognitively and emotionally by applying only traditional methods, for example, transferring lectures and individual traditional tasks on the network (Ruokamo, Tella, Vahtivuori, Tuovinen, & Tissari, 2002). Learning is engendered in network environments and elsewhere but only through students' own activity, with a significant role played by related cognition, emotions,

social practices and culture (Illeris, 2002; Tella et al., 2004). In addition to individual activity and the related emotions, it is also vital to (Illeris, 2002) learning processes (Hakkarainen, Lonka, & Lipponen, 2004; Lehtinen, 2003; Mercer, 2000/2003).

It can be stated that the emotions and shared emotional states manifested in social-level activity and computer-aided online interaction both unite and divide people. Feeling is one of the few things that a person can, in the last analysis, share with another person (Damasio, 2000/1999b; Siegel, 1999; Tamminen, 2004). Moreover, a Connet student in our data during the *Education, organisation and culture* study unit wished to share an emotional state when beginning a new course. "*The links seemed to have a connection to Socrates, maybe I can return to the topic after I've checked it out, it would be nice if someone else would be excited about it too!*" (Student 1). Then, the challenge for teachers and teaching is organising online activity, i.e. teaching, so that it engenders and nurtures lasting learning, where the significance of emotion needs to be taken into account both on the individual and group level.

## 2. Research Methodology

The research is interpretive as it seeks to understand and interpret online education, the emotional learning experiences of the students and the developing pedagogy. Lehtonen et al. (2003: defines this as exploring "...socially meaningful action through the direct detailed observation of people in natural settings in order to arrive understandings and interpretations of how people create and maintain their social worlds".

To retain the integrity of the phenomena being investigated, efforts were made to 'get inside' the person and to understand them (Sweller & Chandler, 1994). The interpretive researcher began with individuals or groups and sets out to understand their interpretations of the world. Emergent theory from particular situations should be grounded on data generated by research acts.

Grounded theory was chosen as a way of observing the complex social/educational activity in online education. One of the key principles is that grounded theory is



participatory: it is a research through which practitioners work towards the understanding and improvement of their own practices. However, in this work, the researcher's role was as planner and external observer; the teacher took the lessons.

Grounded theory is a general methodology for the development of a theory. During the research, the theory develops through the interaction between the systematic data collection and the continual theoretical analysis. The goal of the analysis is the verification of the hypotheses found during the research process such as the clarifications and relationships between relevant concepts. In general, grounded theory methodology is applicable to research areas where there is relatively little knowledge or where we want to bring fresh perspectives. The main interest is the collection of data about what people are doing or not doing with respect to their actions/interactions, and how the circumstances are changing, and what are the effects of the actions, and what strategies are used.

The researcher needed a comprehensive set of data collection techniques in order to get as much of information as possible relating to the research questions. Different data were intended to triangulate the research and build validity. To analyse the qualitative data, the researcher employed the qualitative and inductive methodology. A course plan was established to support this work, based on four lessons;

- Introduction and training in using online education materials.
- Individual students work out solutions using the online education materials.
- Students develop solutions as a group inside the online education materials.
- Individual students develop solutions for an exhibition in the online education materials.

Interdisciplinary research was undertaken to enhance the quality of online courses. Compared with traditional face-to-face teaching, online education demands new learning skills from the students. Resource management, new modes of communication, risk carrying capacity

and activity are emphasised within new learning environments. One extremely pressing question here is "How to encourage these elements whilst aiming at a better understanding of emotionality?"

This methodological approach involved the application of both qualitative and hermeneutic approaches triangulated with 'grounded theory'. The information acquisition phase was open, and the process of analysis was based purely on the research data. The data comprise different kinds of narratives and conversations related to formal learning, such as, self-evaluations and networked thematic discussions. The effectiveness of the use of narratives is based on the continuous construction of one's identity by the means of story-telling activities. That is why we concentrated on finding as sound and whole stories as possible. Triangulation enabled interpretation and analysis of the material. Interdisciplinary elaboration was used to create a theoretical background and frame the analysis concerning the empirical material.

## 2.1 Findings Emerging from Pilot Research

Two perspectives of observation and analysis were adopted in the pilot research work. The first-order perspective utilised direct observation and recording video, audio and focussed on the online learning activity. The second-order perspective had a phenomenological basis which considered how the students feel about the online learning tasks comprising observation, conversation and stimulated recall interview answers (e.g. in problem situations).

The emotional situations related to online learning were examined from the perspectives of cognitive load, emotional load, situational anxiety/frustration and situational pleasure.

The first order perspective revealed that both external reactions that could be seen to represent emotional reactions. Moreover, the verbal activity contained such expressions. The second order perspective also revealed many expressions of emotionality with regard to how the students felt the situation.

Results from the first- and second- order perspectives did

not always agree with each other. It was apparent that the students did not report all serious problems with the online learning materials where the learning media failed to function during their learning activities. The situational anxiety/frustration was obvious in situations where serious problems occurred - where the problems occurred with the supporting computer programs. The pedagogical model and social structures did not cause significant anxiety in this research. Some of the anxiety was related to the difficult tasks to perform. Nevertheless, the functionality of the technology was main cause of those situations.

Finally, functionality of the systems is very important because the situational pleasure situations were apparent in situations when the interactive learning simulations provided feedback that the attempt was successful. Furthermore, group processes seemed to be causing situational pleasure (verifying that the Computer-Supported Collaborative Learning CSCL processes may be sources of situational pleasure). The main source of the pleasure situations still seemed to be the possibility to use the interactive learning simulation program ("the mental tool/tool for group visualization") that gave direct feedback about the success of their thinking and problem solving. The success of the cross communication in different forms (linguistic/visual) was the critical aspect for the successful activities using online learning materials as well as the source of situational pleasure.

### 3. Embodiment - knowing, feeling and interaction

By embodiment, we refer to an entity of experience and interaction that contains the forms of embodiment, *embodied cognition* and *act of embodying* (Damasio, 2001/1994; Hirose, 2002; Hyvönen, Lahti, Littleton, & Marjomaa, 2003; Hyvönen, Marjomaa, & Lehtonen, 2003). In other words, knowing and feeling are experienced in the entire body, and the body also serves as an interactive system that receives, interprets and conveys information. The manifestations of embodiment relate the emotional state and the experiences of students and their desires and intentions in the processes of teaching, studying and learning (Damasio, 2001/1994;

Hyvönen, Lahti, & Marjomaa, 2003; Hyvönen, Marjomaa et al., 2003).

It is illustrative that, in the "*I as a learner*" essays (N=12) by the online students of the study unit "*Education, organisations and culture*" in the Cornet project of the Finnish Virtual University, scientific goals were also expressed as emotional goals, as demonstrated by the following example, "*I think it would be even more interesting to know how I could learn to have real peak experiences in science and my studies as well*". (Student 2.) The students' expressions involve both emotions and rationality, which are not opposites (Damasio, 2001/1994; Sweller & Chandler, 1994). Embodiment and its emotion have frequently been decontextualised in online teaching and studying, perhaps partly because of the cognitive and constructivist views and the related view on knowledge almost exclusively emphasise knowledge and knowledge construction that is separated from emotion. Views on learning hardly bring up personal knowledge, of whose existence, transfer and interpretation are embodied, who are all the individual personality or what are the personal life situations. Has decontextualisation been influenced, along with the proliferation of online teaching, by a restricted view of the learning environment? When discussing online learning environments (Tella et al., 2004), one must remember that the environment always is a physical, psychical, social and cultural whole and a cognitive-emotional model of the mind that is generated through personal interaction and enables the participants to produce culture, feel joy and frustration and interact with each other and their environment. (Hyvönen & Juujärvi, 2004).

In connection with cognition, embodied cognition and act of embodying, brain researcher Antonio Damasio (Damasio, 2001/1994) states that emotions should be included in the concept of the mind. Yet many scientific descriptions of cognition fail to account them when analysing cognitive systems. Emotions are frequently viewed as fuzzy matter that cannot share the stage with thoughts and tangible content. The view that removes emotion from the mainstream of cognitive science has its counterpart in the field of traditional brain research and,

we believe, in the field of learning research. (Damasio, 2001/1994). Nevertheless, emotions are as cognitive as any other observable content of the mind. Emotions represent an individual-level system that provides us with valuable information about the state of our own bodies and the relationship of ourselves and our bodies with ongoing activity (Ihalainen, 2004; Siegel, 1999; Simanav, 1981, 2028), such as studying. How an activity proceeds is largely guided by emotions. (Burkitt, 1999; Damasio, 2001/1994; Siegel, 1999). It can be assessed that, in all activity, our knowledge and acts are also emotionally driven, even though we do not always notice it. However, emotional assessment can be perceived, for example, in the following comment by a student. *"I feel that what is involved..."*. The system of emotions is, according to Damasio (2000/1999b), a largely unconscious yet important subsystem of our thinking. Simanav states in his *information theory of emotions*: (Simanav, 1981, 28) *Emotions are the integral parameter, which is the basis for decision-making. Emotions reduce all variety of purposes in their simplest forms into only two of them: achievement of positive emotions and elimination of negative emotions* (cf. Damasio, 2000/1999b, 41).

### 3.1 Situational anxiety and mental load.

*Situational anxiety* is an emotional response to a situation that is perceived as too rapidly changing, difficult in its characteristic features. Anxiety may be seen also in relation to fear; those may be seen in a way compelling feelings (Thompson & Madigan, 2005, 162; Huttunen 1997; Nathanson 1992). In strongest forms situational anxiety is sometimes replaced by situational fear and avoidance toward the whole activity or situation (Thompson & Madigan, 2005, 162; Huttunen 1997; Nathanson 1992).

Situational pleasure, a concept developed by the researchers in contrast, may be understood to be the opposite, an emotional response to a situation that is experienced as easy or pleasant (cf. flow Csikszentmihalyi, 1992). *Mental load* is a concept that has been derived from Sweller's theoretic model of *cognitive load* (Chandler & Sweller, 1991; Sweller & Chandler, 1994) by supplementing it with *emotional load*.

*Mental load* implies an excessive burden in relation to a learner's emotional and cognitive resources that is caused by the structures and activities of study-related equipment and materials, which diminishes learning capacity. A part of this load is due to learning of the issue being processed and a part to concurrent effects of negative emotions. (see e.g. Thompson & Madigan, 2005)

### 3.2 Situational anxiety and situational pleasure

This can be referred as, feelings of fear and helplessness and experiencing a situation as threatening inhibit learning. On the other hand, the situation itself may be remembered well but what one attempted to study during it is often forgotten. Indications of this have been found within neuropsychology, in particular. (Booth-Butterfield, 1988; Cahill, McGaugh, & Weinberger, 2001; Damasio, 2000/1999b; Virsu & Haapasalo, 2001). Situational pleasure, i.e., positive emotional substance that is evoked in a situation of learning or other activity, has an effect of supporting, even enhancing, remembering, cognitive functions and learning. (Damasio, 2000/1999b; Virsu, 1995). This is utilised in different areas, for example, in the entertainment industry where the activity itself is entertaining. The pleasure provided by the senses and embodiment is an important element in the contexts of learning.

Also text-based interaction affords situations of pleasure. In the following quote, a student searching for materials for his assignments shares through email his joy that was evoked in the domain of music. *"It's a done deal. I'll start typing once it's evening. I just found a few songs of my favourite band on the net and I can't help spreading the good news around."* (Student 3. Email.)

The above quote also relates how a feeling of solidarity may develop. According to Chayko (2002), it develops from pleasure, which proceeds from a shared emotional state when participants realise that they enjoy the same interests or find that they were born in the same city, etc. The interpretations of similarity may be erroneous yet they engender positive emotions and solidarity. (Chayko, 2002).



The fact how easily situations are felt to be a burden or a pleasure is also influenced by the student's earlier experiences and attitudes. In the following, a student relates the significance of emotions and expectations and brings up the manner of interpreting and experiencing integral to his own model of the mind. *"Feelings and expectations too are crucial for the learning process and have an effect on what and how I learn. As a learner I could symbolise myself as a round red ball. Red because I have a positive attitude, which usually has made learning pleasurable."* (Student 4.)

In the following description a student demonstrates the power of emotions and mood in the context of studying. An irritated and frustrated mood lingers about the text. According to the student, a teacher's patronising manner in school expressed underestimation of learners, which affected his mood, behaviour and studies. *"But in retrospect, in comprehensive school I worked hard and needed teachers whenever they had a patronising attitude towards students. In gymnasium, after teacher authority slackened and the learning environment became uninteresting, I ended up being expelled from the majority of biology, psychology, geography and English courses because my criticism reached a peak that was disturbing. When we were taught the dates of the Second World War, I was reading about the massacre on the Tien-an-Mien square and was moved to tears."* (Student 5.) Whether this had an effect on learning in the end, cannot be concluded from the description.

The significance of situational anxiety and fear is revealed in its extreme form when a person faces a threatening situation and concentrates on repulsing danger or escaping to safety. Another outcome may be passivity. Such situations are often accompanied by neurological and hormonal responses, for example, perspiring hands and stuck on thoughts. (Adolphs, Tranel, Damasio, & Damasio, 1995; Cahill, 1998; Siegel, 1999). Under these conditions, one is strangely controlled by emotional assessment and relatively rigid action patterns instead of flexible creativity and conscious problem solving (Siegel, 1999).

It has frequently been observed that the reactions

caused by emotional assessment and situational anxiety have effects that inhibit studying, learning and remembering, as well as being linked to study avoidance behaviour (Farnill, 2001; Griffin, 2000; Siegel, 1999). Situational anxiety disrupts studying, especially when one studies something for the first time, and may lead to study avoidance behaviour (Oatley & Jenkins, 1996), as, dropping an online course. In later stages of studying, however, challenges or situational anxiety arising from a learning topic or problem may also have positive effects. In the following, a student describes an insurmountable situation caused by a study unit where the only solution was to leave off the unit. The quote also describes how the expectations and experiences of online studying do not always coincide. *"This simply won't work at all now ... online studying takes up three times as much of energy, time and effort as regular studies. I don't have any other option left except to drop out of it all."* (Student 6. Email.)

### 3.3 Mental load

Mental load has a crucial effect on alertness and selective attention. For example, an excessive load, deficient materials, equipment or navigational structure or incompetent use of hypermedia may, along with the load caused by subject matter, lead to rapid exhaustion and scattering of selective attention, which is important for studying, towards multiple targets. Moreover, excessively low demands of the subject matter may reduce alertness and diminish motivation (Virsu, 1991, 1995), as told by a student (7): *"I'm restless because I've got a short attention span and easily get bored if learning fails to motivate me. I'd rather have an excessive challenge; the easy stuff doesn't appeal to me."*

Poor network orientation, study counselling and ambiguously compiled and expressed information about study content and goals can cause excessive load and apathy, even though such information is intended to help perceiving cognitive structures. The following quote is by a student who reflects on why students fail to benefit from the study instructions of online teaching. *"The instructions are too long. On the Internet, people have already realised ten years ago that people always ask the same questions through the FAQ. This 'defect' in asking the*

*questions is so common that we can't perform massive brainwashing but need to do something about our materials. ... But it's possible to add to confusion. Even a little ambiguity increases the risk of confusion. The control is over there where the material is produced, not where the students are.*" (Email from Student 8)

Furthermore, acquisition of study materials appears to cause what is felt to be an extra load. *"Myself, I spent last week fishing for books and what a gloomy experience it was!"* (Email from Student 9.) *"In any case, if you haven't even seen the books it's awfully difficult to know how to write or present anything. If I can't soon come up with a way to deal with this smartly without burdening the rest of the group, unfortunately I may have to stop this..."* (Email from Student 10)

A crucial factor for mental load is time management. Maintaining the pace on a course designed with a fixed schedule may entail problems. This causes anxiety to both the student and the group. The first of the following quotes is from a message by a student where he reports why it has been impossible for him to be active during a study unit. The second quote relates the life situation in which a student attempts to study. *"Now I've got to send something so that the gang would believe I still exist. I've had many things, war wounds... Was there deadline for deciding on topics? (Now it comes out how poorly I've been involved, I'm a little ashamed of myself...)"* (Email from Student 11.) *"I need to go again to work today but I'll try to get something done later in the evening."* (Email from Student 3)

### 3.4 Factors affecting situational anxiety and mental load

On the basis of our empirical data it can be stated that what is essential in online teaching, studying and learning is that the situation and the activity can be felt to be sufficiently secure. By the feeling of security we imply that a student can rely on instruction and tutoring, technology, scheduling, interaction and peer groups. A secured environment encourages unconventional thinking, creative practices and trial and error (Hyvönen & Juujärvi, 2004; Siegel, 1999).

An online student must achieve a harmony with his internal qualifications and difficulties and the emotions that they give rise to. Internal qualifications include goals, interest, motivation and will, i.e., volitional factors. Inner difficulties, in turn, are related to beliefs about ability, attitudes and various fears. Examples of external difficulties include the so-called accessibility factors or gaps, which occur, for example, when a student does not have use of a computer, necessary software or sufficient support, such as a support person. A significant external difficulty may also be considered to be vague expectations of cognitive activity or online orientation: because of defective instructions or tutoring the student is unable to perceive the entirety of action or content, its subgoals and subactivities. In addition, the terminology used may cause perceptual gaps. "Getting lost" because of faulty orientation (Galperin, 1989) is unpleasant and often leads to intense situational anxiety and mental load with numerous consequences. External difficulties and qualifications can be addressed by those planning for and offering study units. In an optimal situation, difficulties are removed and qualifications reinforced so that teaching and studying can have potential to result in learning. (Hyvönen, 2002).

In the following paragraphs we highlight the factors that are related to: pedagogical models and guidance, reliability of technological solutions, reliability of equipment and content. According to the data and experience, these are the most central sources of situational anxiety and factors that affect mental loading.

### 4. Pedagogical models and guidance

The structure, goals and methods of a study unit are usually described and introduced by using various online materials and tools. Course planners are not necessarily qualified designers of online materials and tools or online material producers qualified pedagogues. A student who has designed several web sites writes as follows: *"How many online projects employ a 'real' professional? There are so many that feel they can produce material that is just fine after a bit of training. The net is perceived too simplistically."* (Email from Student 8)



The purpose of online instructions is to enable quick grasp of the structure of studying so that a student can subsequently assess his own needs, goals and time management. If the tools and instructions are not clear enough (*improper orientations*, c.p. Galperin, 1989 (Page, Lehtonen, & Thorsteinsson, to appear), the student may try to find the fault in himself. *"There are many online students who can't 'cope with computers'. They may experience this as an oppressive failure. If they are asked how well an online course functions, they may blame same problems on their own clumsiness and think that 'I should have managed it faster' or that 'it's my fault'".* (Email from Student 8).

Tutoring must always be reciprocal and tailored to each student's needs. Students may feel that they are left alone with their problems if tutoring is delayed or not available. Experience also shows that university students find it difficult to organise groups on their own and that work that is intended to be collaborative will not automatically take place. *"It never became very clear how an online reading circle was supposed to be organised in practice."* (Email from Student 12)

The significance of a general orientation period lies in the creation of a common ground (*grounding process*) (c.p. Galperin, 1989). This is the time when shared goals, rules, meanings, operational principles and fundamental knowledge that are required of everybody will be created and clarified and the necessary tools provided (Mercer, 2000/2003). A shared basis of online orientation functions as a cognitive and mental framework between people and technologically-based equipment. The creation of a shared basis particularly decreases mental load, situational anxiety and contributes to the necessary feeling of security. Also modelling can be utilised to clarify a student's position so that selective attention and study processes will proceed optimally. Such models provide the student with a script and a pattern of thought about what, how and when he should act/react.

## 5. Technological solutions

Situational anxiety and mental load can also be caused by the technological solutions for activity and interaction.

Related factors are students' ability and inability to use information and communication technology and, for example, difficulties in using applications needed for certain courses. The technology must be suitable and usable for a pedagogical context (Mattus, 2004; Tella et al., 2004). For instance, two views have been expressed on the suitability and usability of an online study environment that we have used. Students were critical of a tool that did not intuitively correspond to user expectations about its logic of operation but, through its complexity and inflexibility, lead to situational anxiety and desire to withdraw. The producers of the study unit defended the study environment on the grounds that it taught students by forcing them to face problem solving, i.e., one had to solve the problems involved in using the study environment in order to proceed. Problem solving, then, was seen as an element of the current study unit. Consequently, the key issue is the ability to tolerate mental loading how far will a student be able to progress in a cognitively and emotionally taxing environment and to what extent does the actual studying of the content suffer from such an environment. An environment or a tool should not be a hindrance but rather an instrument for thinking and problem solving (Fjortoft & Sageie, 2000).

## 6. Reliability of equipment

Unreliability of the equipment in technological teaching, studying and learning environments, i.e., computers, networks, operating systems and software, causes fear of failure. This was also revealed in a study on the experience of the aged. An interviewee relates *"And then the screen played whatever tricks, every now and then, out of spite. But it did swallow up my text many times and showed some crazy things on the display."* (Hyvönen, 2002).

Technological problems can be diminished by improving the reliability of equipment under different conditions of use, providing clear support systems for solving experienced problems and improving the usability of diverse equipment and their suitability for teaching and studying practice. The online communication solutions of the near future, such as IP multimedia communications, are valuable options because of their features that convey emotional factors more comprehensibly.

(Lehtonen, Karppinen, Matikainen, Sökkinen, & Ruokamo, 2005). On the one hand, the equipment used for teaching and studying has significant potential but, on the other hand, may give rise to feelings that students are unable to keep up with the development. (Hyvönen, 2002; Lehtonen et al., 2005; Virsu, 1995).

## 7. Content

From the point of view of meaningful learning, the goal is offered, instead of make-believe assignments, to solve problems and challenges rooted in real life. A creative design project for the needs of an actual shipping company on a Connet course is an example of a real-life assignment. The student needed to see where the outcome ended up and whether it had an actual effect in real life.

A Connet student (13) brings up the significance of content while first reporting a failed studying and learning experience of a mathematics lecture and then a successful experience on a psychology course: *"I experienced lectures of a very different type last autumn on a psychology course on new know-how and learning environments. We were encouraged to discuss, we worked in small groups and we were able to choose the topic that interested us for our essays. This course left a much more positive impression..."*

## 8. Reward and feedback in online teaching and studying

Learning requires tutoring and other forms of feedback for both successes and failures. Goal orientation, situational pleasure and a harmony of mental load, as well as the joy of succeeding derived from learning something new, enable students to keep trying, despite of the failures and occasional displeasure. Studying at the upper limit of one's current skill level, in *the zone of proximal development* [*"at the ladder of challenges"*] (Vygotski, 1978), gives students continuous feedback for successes and failures, which is essential for learning (Virsu 1991). Feedback provided by an actual person or generated by a technological system is significant from the points of view of both motivation and actualisation of the learning process. Giving feedback does not only mean one-sided

commentary, on the contrary, it is an interactive and embodied situation where emotions are highly significant.

Reward and feedback are two different things. Feedback informs whether the learning process was successful or not and how the activity should be modified in the future. Reward, in contrast, is a form of feedback that offers a deeply emotional experience in the form of pleasure. The systems in the brain that are activated by feedback or reward are different. A reward modulates or guides, learning in the brain, as is currently understood, through emotional pleasure mechanisms, such as the amygdala. Feedback, in contrast, activates pleasure mechanisms hardly at all. Feedback that opens new views also supports learning new things and creative insight, which means that it also modulates learning emotionally. Although rewarding schemes have an effect on the motivation to learn, one should note that the motivation to learn is predominantly endogenous. How and what each person experiences while rewarding varies greatly. (Virsu, 1991.)

A benefit of online teaching is the opportunity for quick feedback and interaction, for *intense interactions*. This interactive nature applies also to the instruments of information and communication technology used for teaching online courses, which at their best function as tools that support the student's thinking and problem solving, as instruments of thought (Lehtonen, manuscript). Students especially expect that online equipment and materials provide forms of interaction that facilitate studying (cf. Prensky, 2001). The most natural manifestation of interaction is a dialogue, in some situations of online studying between a technological agent and an actual person. Interaction and activity in online teaching are also defined by to what extent the student can influence the course of his studies via his own activity. One may also speak of social process-oriented and content-oriented, or data-oriented, online studying. Both are needed for practical online teaching and studying, but a suitable balance must be found between the two. (Lehtonen, manuscript).

## Conclusion

This study attempts to present the connections on several levels whereby emotions are linked to learning in online teaching and online studying. Emotionality is seen to influence studying and learning transdisciplinarily, using different theoretical viewpoints and seen simultaneously on different levels of theoretical research and understanding; beginning from the level of internal neuropsychological / cognition science emotional processes and binding it together with the higher level theories of emotions and social cognition for human interaction and problem solving on ICT mediated environments. The emotionality is seen simultaneously on personal and social (=interpersonal) as well as in cultural and inter- cultural or transcultural levels. The perspective is seen to produce understanding where the micro and macro levels theory of human emotional behaviour is been used to support each other's. (see Tella, Lehtonen et al. 2004; Lehtonen, Vahtivuori-Hänninen et al. 2003; Lehtonen & Vahtivuori 2003; Uhari & Nieminen 2001.)

Studying needs to be meaningful and must produce activity that is emotionally, socially as well as culturally appropriate on both individual and group level. Also it has to take student context into account, i.e., their life situation. The emotional system has multiple effects, in addition to learning-oriented activities, on whether something is learnt and remembered later. In online studying, the equipment used also provides challenges. The essential factors to be accounted for planning and offering online teaching and studying, include reducing the students' mental load and situational anxiety, which are influenced by several factors, to a sufficiently low level and creating and maintaining an appropriate emotional environment. These will function not only as sources of motivation but also as supports of learning on the level of neurological systems. A comment by a student (14) "*I just love learning situations where the separate pieces begin to form meaningful whole in my mind,*" which refers to the assertion in the title of this article: *learnt without joy, forgotten without sorrow!*

## References

- [1]. Adolphs, R. (2002) Neural systems for recognizing emotion. *Current Opinion in Neurobiology*, 12, 169-177.
- [2]. Adolphs, R., Tranel, D., Damasio, H., & Damasio, A. R. (1995) Fear and the human amygdala. *Journal of Neuroscience*, 15(9), 5879-5891.
- [3]. Alanen, P., Sintonen, M., Hyyppä, M., & Järvillehto, T. (2003) *Lääketiede ja tieteenteoria* [Medicine and science theory]. Turku: Kirja-Aura.
- [4]. Bion, W. R. (1962) *Learning from experience*. London: Kornac.
- [5]. Booth-Butterfield, S. (1988) Instructional Interventions for Reducing Situational Anxiety and Avoidance. *Communication Education*, 37(3), 214-223.
- [6]. Borod, J. C. (2000). *The Neuropsychology of emotion*. New York: Oxford University Press.
- [7]. Burkitt, I. (1999) *Bodies of thought: embodiment, identity and modernity*. London: Sage Publications.
- [8]. Cahill, L. (1998) *Neural Mechanisms of Emotionally Influenced Memory*, Retrieved 25<sup>th</sup> August, 2005, from <http://darwin.bio.uci.edu/neurobio/Faculty/Cahill/cahill.htm>
- [9]. Cahill, L., McGaugh, J. L., & Weinberger, N. M. (2001) The neurobiology of learning and memory: Some reminders to remember. *Trends in Neurosciences*, 24(10), 578-581.
- [10]. Chandler, P., & Sweller, J. (1991) Cognitive load theory and the format of instruction. *Cognition and Instruction*, 8, 293-332.
- [11]. Chayko, M. (2002) *Connecting: How we form social bonds and communities in the Internet age*. Albany, NY: State University of New York Press.
- [12]. Csikszentmihalyi, M. (1992) *Flow: The psychology of happiness*. London: Rider.
- [13]. Damasio, A. R. (2000/1999a) *Spinozaa etsimässä. Ilo, suru ja tuntevat aivot* [Looking for Spinoza. Joy, sorrow, and the feeling brain] (K. Pietiläinen, Trans.) Helsinki: Terra Cognita.
- [14]. Damasio, A. R. (2000/1999b) *Topohtumisen tunne. Miten tietoisuus syntyy* [The Feeling of What Happens:



Body and Emotion in the Making of Consciousness] (K. Pietiläinen, Trans.) Helsinki: Terra Cognita.

[15]. Damasio, A. R. (2001) Fundamental feelings. *Nature*, 413, 781.

[16]. Damasio, A. R. (2001/1994) Descartesin virhe. Emootio, järki ja ihmisen aivot [Descartes' Error: Emotion, Reason and the Human Brain] (K. Pietiläinen, Trans.) Helsinki: Terra Cognita.

[17]. Dennett, D. C. (1996) *Kinds of Minds. Towards an Understanding of Conscious*. London: Weidenfeld & Nicolson.

[18]. Farnill, D. (2001) Communication in a medical emergency. Retrieved 12th February, 2003, from <http://www.gmp.usyd.edu.au/vguide/students/samplew/msep/learningtopics/Kk9HHkf.html>

[19]. Fjortoft, I., & Sageie, J. (2000) The Natural Environment as a Playground for Children Landscape: Description and Analyses of a Natural Playscape. *Landscape and Urban Planning*, 48, 83-97.

[20]. Galperin, P. J. (1989). Organization of mental activity and effectiveness of learning. *Soviet Psychology*, 27(3), 65-82.

[21]. Gallese, V., & Goldman, A. (1998) Mirror neurons and the simulation theory of mind-reading. *Trends in Cognitive Sciences*, 2(12), 493-501.

[22]. Griffin, J. H. (2000, July 1) Inhibitions and related terms. Retrieved 20<sup>th</sup> May 2002, from Oklahoma State University Web Site: <http://home.okstate.edu/>

[23]. Haapasalo, S. (1993) Aivojen oppimistapahtuma. *Kuntautetus*, 1/1993, 48-52.

[24]. Haapasalo, S. (2001) Oppiminen NLP:n ja aivotutkimuksen näkökulmista, *Suomen NLP -yhdistyksen Mieli-lehti* 4/2001, 6-14.

[25]. Hakkarainen, K., Lonka, K., & Lipponen, L. (2004) Tutkivo oppiminen: Järki, tunteet ja kulttuuri oppimisen syöttäjinä. Porvoo/Helsinki: WSOY.

[26]. Hari, R. (2003) Sosiaalisen kognition hermostollinen perusta. *Duodecim*, 119(15), 1465-1470.

[27]. Hirose, N. (2002) An Ecological Approach to Embodiment and Cognition. *Cognitive Systems*

*Research*, 3/2002, 289-299.

[28]. Huttunen, M. (1997) Tunnetilat silta kehan ja mielen välillä. *Duodecim*, 113, 1385-1391.

[29]. Hyvönen, P. (2002) Tietaverkot ikääntyneen oppijan voimaantumisprosessissa. [Pro gradu. Faculty of Education, Univ. of Lapland]. Rovaniemi: University of Lapland.

[30]. Hyvönen, P., & Juujärvi, M. (2004) Representations in Playful Learning: Children's Views of Playful Environments. In L. Cantoni & C. McLoughlin (Eds.), *Proceedings of ED-MEDIA 2004 World Conference on Educational Multimedia, Hypermedia & Telecommunications*. June 21-26, 2004; Lugano, Switzerland. Norfolk: Association for the advancement of computing in education AACE, 3591-3596.

[31]. Hyvönen, P., Lahti, J., Littleton, K., & Marjomaa, E. (2003) Embodied Subjects and Intentionality in Virtual Learning Environments. *Proceedings of the ED-Media 2003 - World Conference on Educational Multimedia, Hypermedia & Telecommunications*, Honolulu, Hawaii, USA, June 23-28, 2003 [CD-rom], 2122-2129.

[32]. Hyvönen, P., Lahti, J., & Marjomaa, E. (2003, June 23-28) "Embodied Subjects and Intentionality in Virtual Learning Environments". Paper presented at the ED-Media 2003 - World Conference on Educational Multimedia, Hypermedia & Telecommunications, Honolulu, Hawaii, USA.

[33]. Hyvönen, P., Marjomaa, E., & Lehtonen, M. (2003) Theoretical Corner Stones and Applications of Socio-Constructivism in Virtual Learning [manuscript].

[34]. Hyvönen, P. & Ruokamo, H. (Prapasal) Leikillisyyden ominaisuudet ohjaamisen, leikkimisen, pelaamisen ja oppimisen OLPO-mallissa. Into (Eds.) Smeds, R., Tella, S., Ruokamo, H., & Multisilta, J. Oppiminen ja tieto- ja viestintätekniikka opetuksessa ja opiskelussa.

[35]. Ihalainen, M.-L. (2004) Tunteet ryhmän dynamiikassa ...tunteiden alemmassa vaiheella alla meidän ainoa todellisuutemme... *Ryhmätö*, 4/2004, 18-26.

[36]. Illeris, K. (2002) The three dimensions of learning. *Contemporary Learning Theory in the Tension Field*

between the Cognitive, the emotional and the Social. Roskilde: National Institute of Adult Continuing Education (Roskilde University Press)

[37]. Kernberg, O. F. (1995) Aggression in personality disorders and perversions. New Haven: Yale University Press.

[38]. Lehtinen, E. (2003) Computer-supported collaborative learning: An approach to powerful learning environments. In E. De Corte, L. Verschaffel, N. Entwistle & J. Van Merriboer (Eds.), *Unraveling basic components and dimensions of powerful learning environments* (pp. 355-3) Amsterdam: Elsevier.

[39]. Lehtonen, M. (manuscript) Oivallusobjektit verkko-opetuksessa ja -opiskelussa.

[40]. Lehtonen, M., Karppinen, P., Matikainen, T., Säkkinen, R., & Ruokamo, H. (2005) Teknologiavälitteinen multimediaviestintä opetus-opiskelu-oppimisprosessin ja tutkimuksen osakomponenttina: Erilaisten käyttöindikaatioiden tarkastelua MOMENTS -metamallin näkökulmasta. In M. Lehtonen & H. Ruokamo (Eds.), *Lapin tietoyhteiskuntaseminaari tutkijatapaaamisen artikkelikirja 2004* [Proceedings of the Lapland Information Society Seminar Researcher Workshop 2004]. Rovaniemi: University of Lapland, Faculty of Education, Centre for Media Pedagogy (CMP), Lapin Yliopistopaino. Retrieved 20th May, 2005, from <http://ktk.ulapland.fi/ISBN951-634-919-6>

[41]. Lehtonen, M., & Vahtivuori, S. (2003) Verkko-opetuksen teoreettisen metamallin kehittämisen lähtökohtia MOMENTS hankkeessa. In J. Levonen & T. Järvinen (Eds.), *TUOVI: ITK '03 Tutkijatapaaamisen artikkelit*. Hypermedialaboratorion verkkojulkaisuja - Hypermedia Laboratory Net Series; 3. Tampere: Tampereen yliopisto, Hypermedialaboratorio, 5869. Retrieved 20th May, 2005, from <http://tampub.uta.fi/tup/951-44-5696-3.pdf>

[42]. Lehtonen, M., Vahtivuori-Hänninen, S., Ketamo, H., Kili, K., Paunonen, U., Tella, S., Koskimaa, R., Nurmi, K.E. & Multisilta, J. (2003) Towards multidisciplinary moments metamodel for network-based education. In R. Latva-Karjamaa & P. Nuora (Eds.), *Interlearn - Multidisciplinary approaches to learning. Programme and abstracts* (pp.

83). Helsinki: Helsinki university press.

[43]. Mattus, M.-R. (2004) Oppimisesta ja opettamisesta verkon aikaan: Motto: Jo muinaiset roomalaiset rakensivat tie- ja vesijohtoverkostoja... Peda-Forum, 1/2004.

[44]. Mercer, N. (2000/2003) Words and minds: How we use language to think together. London: Routledge.

[45]. Nathanson, D.L. (1992) Shame and Pride: Affect, Sex, and the Birth of the Self. New York, NY: W.W Norton & Company.

[46]. Oatley, K., & Jenkins, J. M. (1996) Understanding emotions. Cambridge, MA: Blackwell.

[47]. Page, T., Lehtonen, M., & Thorsteinsson, G. (to appear) The Web-Orientation Agent (WOA) for Simulated Learning in Technology Education. *International Journal of Learning Technology (IJLT)*.

[48]. Pitkänen, A. (2003) Tunteiden neurobiologiaa. *Duodecim*, 119(15), 1471-1478.

[49]. Prensky, M. (2001) Digital Game-Based Learning. New York, NY, USA: McGraw-Hill.

[50]. Ruokamo, H., Tella, S., Vahtivuori, S., Tuovinen, H., & Tissari, V. (2002) Pedagogical Models in the Design and Assessment of Network-Based Education. In P. Barker & S. Rebelsky (Eds.), *Proceedings of ED-Media 2002*. Denver, Colorado USA, 1676-1681.

[51]. Siegel, D. J. (1999) The Developing Mind: Toward a Neurobiology of Interpersonal Experience. New York: Guilford Press.

[52]. Simonov, P. V. e. (1981) Emotional brain. Moscow: Science.

[53]. Simpson, J. A., & Rholes, W. S. (1998) Attachment theory and close relationships. New York: Guilford Press.

[54]. Sinkkonen, J. (2004) Kiintymyssuhdeteoria - tutkimuslöydöksistä käytännön sovelluksiin [Katsaus]. *Duodecim*, 120, 1866-1873.

[55]. Sinkkonen, J., & Kalland, M. (Eds.) (2001) Varhaiset ihmissuhteet ja niiden häiriintyminen: Kiintymyssuhdeteoria - teoria yksilön kiin(nit)tymisestä tärkeisiin toisiin ihmisiin, kiintymyssuhteen katkoksista ja merkityksestä kehitykselle. Helsinki: WSOY.

- [56]. Sweller, J., & Chandler, P. (1994) Why some material is difficult to learn. *Cognition and Instruction*, 12, 185-233.
- [57]. Tamminen, T. (Ed.) (2004) *Olipa kerran lapsuus*. Helsinki: WSOY.
- [58]. Tella, S., Lehtonen, M., Ruokamo, H., Tissari, V., Ketamo, H., Kiili, K., et al. (2004) MOMENTS-metamalli. Manitieteinen tulevaisuuden verkko-apetuksen, -opiskelun ja oppimisen rakentamisen työväline [Verkojulkaisu]. In R. Mietola & H. Outinen (Eds.), *Kulttuurit, erilaisuus ja kahtaamiset. Kasvatustieteen päivien 2003 julkaisu*. Helsinki: Helsingin yliopiston kasvatustieteen laitos, 244-255.
- [59]. Thompson, R. F., & Madigan, S. A. (2005) *Memory: The Key to Consciousness*. Washington: Joseph Henry Press.
- [60]. Tomkins, S. S. (1962) *Affect, Imagery, Consciousness: The Positive Affects (Vol. 1)*. New York, NY: Springer.
- [61]. Tomkins, S. S. (1963) *Affect, Imagery, Consciousness: The Negative Affects (Vol. 2)*. New York, NY: Springer.
- [62]. Tomkins, S. S. (1991) *Affect, Imagery, Consciousness: The Negative Affects: Anger and Fear (Vol. 3)*. New York, NY: Springer.
- [63]. Tomkins, S. S. (1992) *Affect Imagery and Consciousness: Cognition: Duplication and Transformation of Information (Vol. 4)*. New York, NY: Springer.
- [64]. Uhari, M., & Nieminen, P. (2001) *Epidemiologia ja biostatistikka*. Jyväskylä: Kustannus oy Duodecim (Gummerus).
- [65]. Uijens, M. (1997) *School didactics and learning*. Hove, East Sussex: Psychology Press.
- [66]. Virsu, V. (1991) *Aivojen muovautuvuus ja kuntoutuminen*. Helsinki: Kuntoutussäätiö.
- [67]. Virsu, V. (1995) Muisti ja älykyys aivojen hermoverkossa. *Psykologia*, 30, 266-277.
- [68]. Virsu, V., & Haapasalo, S. (2001) Oppiminen ja aivojen muovautuvuus kuntoutumisen lähtökohtina. In T. Kallanranta, Rissanen, P. & Vilkkumaa, I. (Eds.), *Kuntoutus*. Helsinki: Kustannus Oy Duodecim, . 72-85.
- [69]. Vygotski, L. S. (1978) *Mind in Society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- [70]. Wolf, N. S., Gales, M., Shane, E., & Shane, M. (2000). Mirror neurons, procedural learning, and the positive new experience: a developmental systems self psychology approach. *Journal of the American Academy of Psychoanalysis*, 28(3), 409-430.

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